

REMARKS

Claims 1-55 are pending in this case. Claims 1-15, 22-24, 38-46, and 54 are withdrawn, as being drawn to non-elected species. Claims 16-21, 32, 33, and 37 have been amended. Claims 56-63 have been added.

The examiner has identified claims 16, 25-28, 32-33, 37, 47-53 and 55 as generic, and has required election of a single species to which the claims shall be restricted if no generic claim is finally held to be allowable.

The Applicant has, as required, elected a species to be examined if none of the generic claims listed above are finally held to be allowable. Of the species defined by the Examiner, the Applicant elects species X, defined by the Examiner as "Figure 16 – Autostereoscopic or stereoscopic viewing system with liquid crystal array – claim 12",

However, the Applicant believes that several of the species defined by the Examiner are incompletely defined, in that Figures which define several of the listed species should, in the opinion of the Applicant, be associated with claims other than those listed by the examiner. In particular, in the opinion of the Applicant, Figure 16 and claim 12 are related to different species.

Therefore, please note that the Applicant's election is intended to refer to the species defined by Figure 16 and by portions of the present disclosure relating to Figure 16, and not to a species defined by claim 12. The distinction between Figure 16 and claim 12 will be discussed in further detail below, following a discussion of the generic claim 16 as related to cited prior art, which discussion provides a background useful for understanding that distinction. A discussion of the Examiner's definition of species VII is also postponed until then, for the same reason.

Applicant notes that new claims 59-62 read on the elected species.

NON-ANTICIPATION OF GENERIC CLAIM 16 BY THE PRIOR ART

General comparison of Kleinberger U.S. Patent No. 5,822,117 with the present disclosure:

The Examiner has stated that Kleinberger et al, U.S. Patent No. 5,822,117 (abbreviated "(117)" in the following) anticipate the generic claims. The Applicant believes that the listed generic claims are not in fact anticipated by Kleinberger

('117), and that the inventions described by the generic claims and by the present disclosure, while similar to inventions of Kleinberger ('117) and having with them certain common elements, are structurally and functionally distinct therefrom, and present major advantages thereover.

In ('117) Kleinberger presents various systems for stereoscopic and for autostereoscopic viewing, some of which comprise one or more layers of switchable liquid crystal elements. Inspection of the systems described in ('117) will reveal that each such system is either a spatially-multiplexed system (simultaneously displaying elements of a right image on a first set of display elements and displaying elements of a left image on a second set of display elements), or else a temporally multiplexed system (displaying elements of a left image on a display at a first time, and subsequently displaying elements of a right image on the display at a second time).

The systems represented by generic claims 16, 25-28, 32-33 and 37 are neither spatially nor temporally multiplexed, hence they are fundamentally different in structure and in function.

Parallax barrier systems are an example of spatially multiplexed systems. For example, figure 14 of ('117) is a spatially multiplexed system, presenting a parallax barrier 90 having opaque sections designed to hide a first set of display pixels from a right eye while leaving them visible to a left eye, and to hide a second set of display pixels from a left eye while leaving them visible to a right eye.

Temporally multiplexed systems, also known as "frame sequential" systems, include the well-known "shutter glasses" systems for 3D stereoscopic viewing. Figures 7-12 of ('117) present a temporally multiplexed system in which the frame sequential method for creating a stereoscopic visual experience in a user is implemented in a (then) new way, essentially "putting the shutter glasses on the screen instead of on the viewer".

Kleinberger ('117) describes a plurality of methods for providing frame sequential 3D viewing without requiring eyewear. Instead of eyeglasses, the systems use two parallel optical layers, positioned between a viewer and a display and relatively close to the display. Each of the layers presents alternating polarization zones. These alternating polarization zones are preferably created by layers comprising moveable switchable birefringent zones which, together with an associated polarizing filter, create moveable switchable polarizing zones. These

polarizing zones are positionable in a manner that enables a viewer's left eye to see the display while preventing a viewer's right eye from seeing the display at first times, and switchable to enable a viewer's right eye to see the display and to prevent a viewer's left eye from seeing the display at second times. In coordinated timing, a display device is rapidly toggled to display a left image at said first times and a right image at said second times, thereby enabling stereoscopic viewing without requiring eyeglasses.

It is a requirement of such systems that the alternation be fast enough to prevent an impression of flickering. This is a disadvantage of Kleinberger's ('117) frame sequential system, in that an inexpensive embodiment will either flicker or be of low resolution (since inexpensive CRT monitors are incapable of both high resolution and high refresh speed), and even an expensive version must be implemented utilizing a bulky CRT as the display device, since current technology does not allow for image switching by LCD or other flat-panel display technologies at a speed sufficient to prevent the impression of flickering.

In Figures 7-12 of ('117), display 1 alternates displaying a left image at first times and a right image at second times, and switchable birefringent element 80 is switched in a manner timed to coordinate with the switching between left and right images on display 1, thereby enabling a viewer's left eye, and not his right eye, to see display 1 when a left image is displayed thereon, and enabling the viewer's right eye, but not his left eye, to view display 1 when a right image is displayed thereon.

Similarly, all relevant portions of Kleinberger ('117') present either spatially multiplexed systems or "frame-sequential" temporally multiplexed systems.

As will be shown below, an invention disclosed by the present application, and defined by generic claims 16, 25-28, 32-33 and 37 is fundamentally different from the systems of Kleinberger ('117'), being neither temporally multiplexed nor spatially multiplexed.

Discussion of generic claim 16 with respect to cited prior art:

With reference now to generic claim 16, support for claim 16 may be found in the text description of Figure 7, particularly between page 36, line 18, and page 38, line 11.

In clear contrast to the examples from ('117) referenced above, and to all other systems presented by ('117), the invention presented in Figure 7 of the disclosure utilizes neither temporal multiplexing nor spatial multiplexing.

Figure 7 of the disclosure shows a display surface presenting an image-and-polarization pattern first described by Rehorn in U.S. Pat. 2,631,496, which display surface is combined with additional optical elements to constitute a system for autostereoscopic viewing of the images encoded in the pattern described by Rehorn. The autostereoscopic system of Figure 7 is operable to adjust for changing positions and postures of a viewer, thereby allowing the viewer to move with respect to the display while autostereoscopically viewing the presented images. The images thus viewed are neither temporally multiplexed (they don't flicker) nor spatially multiplexed (they are at the full resolution of which the display device is capable). A brief summary of the system of Figure 7 follows:

The image-and-polarization pattern presented by Rehorn in (U.S. Pat. 2,631,496) and referenced in the present disclosure on page 36 line 8 will be called "image B" hereafter, adopting Rehorn's name for that pattern. Image B is characterized by the *simultaneous* presentation of elements of a left image and elements of a right image, in *same* regions of a display, in selected polarization orientations. Thus in contrast to the systems presented in ('117'), the invention presented by Figure 7 is neither spatially multiplexed system nor temporally multiplexed. Left and right images are presented simultaneously on same regions of a display, so there is no temporal multiplexing, no fast switching between images because both images are presented at all times. A display presents a left image to a left eye and simultaneously presents a right image to a right eye. Each of the images is presented over the entire surface of the display, there is no alternation of images on alternate pixels or groups of pixels, as would be the case with spatial multiplexing. It may be noted that the language of claim 16 is such as to describe such simultaneous presentation of left and right image elements on same portions of a display:

(a) a first optical construction operable to present *superimposed* left and right image picture elements of left and right images, respectively, said first optical construction being designed so as to *polarize superimposed light of said left image differently from superimposed light of said right image...* (emphasis added)

A further limitation of claim 16 refers to the configuration of the display according to the strictures of Rehorn's "image B":

...and further so as to differently polarize light of said left image being displayed in adjacent picture elements and differently polarize light of said right image being displayed in adjacent picture elements (emphasis added)

In Figure 7, display layer 500 presents left and right images configured according to Rehorn's description of Image B. Display 500 presents two sets of areas distributed across the display, areas from a first set alternating with areas from a second set. The areas are formed as strips of approximately equal width, a first set of which strips simultaneously present elements of a left image with a first polarization orientation A and also elements of a right image with a second polarization orientation B orthogonal to A, and a second set of strips which simultaneously presents elements of the right image in polarization orientation A and elements of the left image in polarization orientation B.

Layer 130 is a birefringent layer with individually switchable elements, and layer 140 is a uniform polarizing layer. (Layers 150 and 160 are optional and not relevant to the present discussion).

The combination of display configuration and optical elements presented by Figure 7 constitutes an autostereoscopic system which overcomes disadvantages of various stereoscopic and autostereoscopic systems presented in Kleinberger ('117), and of other prior art systems. The system of Figure 7 suffers neither from the intrinsic low resolution of a spatially multiplexed system, nor does it produce flickering images, nor does it require expensive fast-switching optical panels, nor does it require unwieldy elements such as CRTs (rather than flat panels) because of switching speed requirements. Figures 8, 9, and 14-18 of the present disclosure present various embodiments of this system, comprising a plurality of mechanisms for displaying Rehorn's Image B on display layer 500.

Thus, the system presented in the present disclosure and described by claim 16 is different from and better than systems described by Kleinberger ('117').

It may be noted that claim 16 has been amended to introduce a further restriction on the referenced "optical construction", as follows: "said optical construction being designed and constructed so as to be located, during use, closer to said display than to said viewer." Claim 16 has been thus amended so as to clearly differentiate between the claimed invention and configurations comprising polarizing eyeglasses, which might otherwise conform to the description of an "optical construction" producing stereoscopic viewing.

Postponed discussion of the definitions of Species VII and X:

Based on the discussion above, it is now easy to differentiate clearly between the invention presented by Figure 16 and invention defined by claim 12, both of which are referenced by the Examiner's definition of species X. .

Figure 16 describes an autostereoscopic system belonging to the family of systems described by Figure 7. The system of Figure 16 is neither spatially nor temporally multiplexed, and is adaptable to both stereoscopic and autostereoscopic viewing.

In contrast, original claim 12 refers to "a control element communicating with said optical construction so as to alternately and out-of-phase switch on and off said pair of on and off switchable liquid crystal arrays, so as to reduce a flickering effect of the system." Original claim 12 relates to an invention described primarily between page 31 line 12, and page 33 line 3 of the present disclosure, where out-of-phase switching is used as a method to achieve rapid switching, for use in a time-sharing display, in order to overcome one of the disadvantages listed above, namely the requirement, by Kleinberger ('117') systems, to utilize a fast-switching-capable CRT as a display device. The invention described on pages 31-33 of the present disclosure show a device and method for achieving rapid switching utilizing LCD panels.

However, the species elected by the Applicant, shown by Figure 7, does not include out-of-phase rapid switching of the liquid crystal arrays, since it is not a temporally multiplexed system and does not require rapid switching at all.

Similarly, the Applicant requests to point out an apparent inaccuracy in the Examiner's definition of species VII: "Figure 7 - Autostereoscopic viewing system with polarizing layers and controlled birefringent layers without temporal multiplexing - claims 13-15".

Claims 13-15 do indeed refer to an autostereoscopic viewing system with polarizing layers and controlled birefringent layers, but, in the opinion of the Applicant, Figure 6 is the relevant figure. The "opaque regions" referenced in Claim 13 (c) are opaque regions formed on combined layers 150 and 160 of Figure 6, to be placed "coaligned with elements of transitions" refer to transitions of between polarizing regions or birefringent regions formed on other layers of Figure 6. A discussion of this embodiment is to be found in the present disclosure on principally between page 33 line 3 and page 35 line 23. See particularly lines 29-30 on page 34.

Figure 7 is associated with generic claim 16, and is specifically referenced as being common to the embodiments represented by species VIII, presented by Figure 8, Species IX, presented by Figure 9, and several of the embodiments presented by Figures 14-18.

Discussion of generic claims 25-28, 32-33, and 37 with respect to prior art:

Generic claims 25-28, 32-33, and 37 relate to a family of embodiments, each of which is differentiated from the inventions of Kleinberger ('117') by being neither spatially multiplexed nor temporally multiplexed, a distinction which has been discussed extensively above.

Figures 14-18 of the present disclosure present systems combining a display, preferably implemented as comprising a first liquid crystal panel, with a switchable birefringent layer having individually controllable cells, preferably implemented as a second liquid crystal panel, to produce 3D display systems. The systems described include projection and flat panel, and are stereoscopic, autostereoscopic, and combined stereoscopic/autostereoscopic. All systems associated with Figures 14-18 require neither spatial multiplexing nor temporal multiplexing.

Generic claims 25-28 describe these systems in general. Support is to be found primarily in the discussions of Figures 14 and 15, pages between page 50 line 7 and page 58 line 25. As shown in that discussion, each pixel of a display layer displays a combined pixel whose light intensity is a function (e.g. a sum) of the light intensities of both a left image at that pixel's coordinates and a right image at that pixel's coordinates. A second liquid crystal layer is used to re-divide said combined image into a reconstructed right image picture element and a (simultaneous and co-located) left image picture element. The result may be viewed stereoscopically,

using polarizing eye-glass filters, or autostereoscopically using the systems described in Figure 7 and discussed in particular between page 57 line 13 and page 58 line 25. Thus, the invention presented by figures 14 and 15 of the present disclosure and described by generic claims 25-28 and 32-33 and 37 are structurally and functionally wholly different from, and superior to, those presented by Kleinberger ('117).

Generic claims 32-33 are supported in general by the discussion of Figures 14-15, page 50 line 7 to page 58 line 25, and in particular by the discussion of an autostereoscopic system between page 57 line 13 and page 58 line 25. Note especially page 57, lines 13-30, which relate utilizing the techniques outlined in the previous paragraph to display a Rehorn "image B", which, in combination with the structures shown in Figure 7 and discussed above, produce a non-time-multiplexed non-space-multiplexed autostereoscopic display.

Generic claim 37 is supported particularly by the discussion of Figure 16, particularly between page 58 line 26 and page 60 line 24. That discussion relates to an embodiment fulfilling the description of claim 25, which embodiment is operably switchable between a first operational mode in which stereoscopic viewing can be accomplished using polarizing eyeglasses, and a second operational mode, fulfilling the description of claim 32, in which autostereoscopic viewing is available and no eyeglasses are needed.

Thus, generic claims 25-28, 32-33 and 37 have been shown to be drawn to an invention substantially different from those presented by Kleinberger ('117').

Discussion of generic claims 47-53 and 55:

In contradistinction to the above, generic claims 47-53 and 55 *do* relate to spatially multiplexed systems. As will be shown, however, these claims related to inventive embodiments not mentioned nor contemplated in Kleinberger ('117).

Claims 47-53 and 55 are of systems utilizing spatial multiplexing, and comprising an optical construction which prevents each eye from seeing light from picture elements or sub-picture elements of an image inappropriate to that eye. Claims 47-53 and 55 relate to various embodiments operable to switch rapidly between alternate positionings of picture elements, or of sub-picture elements, or of said optical construction, so as to maintain autostereoscopic viewing.

Claim 47 is of a device for displaying intermixed (i.e. spatially multiplexed) left and right picture elements of left and right images, and for exchanging the positions used for showing left elements with the positions used for showing right elements, under control of a system responsive to changes in a viewer's position, thereby maintaining autostereoscopic viewing for that viewer, in a system having no moving parts. Support for claim 47 is to be found in particular between page 79 line 14, and page 81 line 9. Note particularly page 80 lines 16-31. No similar system was described in Kleinberger ('117).

Claim 48 is similar to claim 47, except that rather than exchanging picture elements, sub-picture elements (e.g. particular color components of picture elements) are exchanged. Support for claim 48 may be found in particular between page 89 line 33 and page 94 line 19. Note in particular page 90 line 24 through page 91 line 10. No similar system was described in Kleinberger ('117).

Claims 49-51 describe systems for maintaining autostereoscopic viewing an a spatially multiplexed barrier system by translating either a display or an optical construction such as a parallax barrier between two discreet positions, so as to adapt to a user's moving from one position to another. Mechanical translation systems are known. The advance here is to present a system utilizing only two alternate positions. Systems operable to flip from one configuration to another are simple and inexpensive when compared to systems, such as those known in the art, which accomplish autostereoscopic viewing by utilizing devices to create continuous translatory motion of display or of an optical construction. Such prior art devices are relatively complex and expensive, since they are required to produce rapid motion, yet must accurately control that motion. Claims 49-51 describe a device which is simpler and less expensive than prior art devices, to accomplish the same purpose. Support for claims 49-51 is to be found in particular between page 83 line 6 and page 88 line 31. For claim 50, note in particular page 86 line 14 to page 88 line 31. For claim 51 note in particular page 85 line 30 to page 86 line 14. No similar system was described in Kleinberger ('117).

Claim 52 relates to a simplified head-tracking autostereoscopic system which directs monoscopic image data to both eyes of a viewer when sudden and rapid movement of the viewer is detected by a head-tracking sensor. Support for claim 52

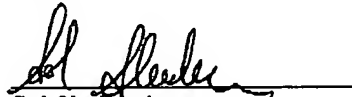
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is found in particular between pages 81 line 20 and page 82 line 6. See in particular page 81, lines 33-35. No similar system was described in Kleinberger ('117).

Claim 53 relates to a simplified head-tracking autostereoscopic system having no moving parts, wherein left image data is directed either to a first set of positions or to a second set of positions, and right image data is correspondingly directed either to said second set of positions or to said first set of positions, selection being made according to positions of left and right eyes of a viewer as detected by a head-tracking sensor. Support for claim 53 is to be found particularly between page 79 line 14 and page 81 line 19. See in particular page 80, lines 16-23. No similar system was described in Kleinberger ('117).

Claim 55 relates to a method of utilizing a display device to provide for autostereoscopic viewing, wherein individual picture elements of the display device are utilized to display sub-picture elements of both left and right images. Support for claim 53 is to be found in particular between page 89 line 33 and page 94 line 19. Note particularly page 90 line 33 to page 91 line 4.

Respectfully submitted,



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Encl:

A three-months extension fee; and
A response transmittal fee for added new claims.